Minerals in Everyday Life

This activity addresses the following essential understanding:

- Minerals are crucial components of countless products used by people every day.

Overview

This activity introduces students to:

- The minerals that go into numerous consumer products.
- The geographic areas where these minerals are found and mined.
- The extent to which cell phone features are dependent on minerals.

Learning Objectives

Students will be able to (1) identify products in the home that are composed of minerals, and (2) describe the minerals used in cell phones and the geographic origins of those minerals.

Time Estimate: 45 minutes

Teacher Preparation

1. Make enough copies of the handout "Minerals in Our Environment" (rooms 1-4) so that each student has a handout for one of the rooms.
2. Make enough of the seven mineral handouts for every student in each small group to have a handout about one mineral.
3. Read "A World of Minerals in Your Mobile Device," from the U.S. Geological Survey.

Procedure

1. Let students know they will explore the minerals in products they use every day, from routine household goods to complex cell phones.
2. Divide the class into four roughly equal size groups. Assign each group a different "room," and distribute "Minerals in Our Environment, Room 1" to group 1, "Minerals in Our Environment, Room 2" to group 2, and so forth. From the handout, ask groups to identify at least three products that are made from petroleum, and have each group select a spokesperson.
3. Reconvene the class into one unit. Ask each spokesperson to share the items that depend on petroleum. Point out that public lands provided $42 billion worth of oil and gas in 2017, supporting more than 200,000 jobs. Note that non-energy minerals also come from public lands, including some that are essential in constructing cell phones.
4. Divide the class into seven roughly equal size groups. Provide the wolframite handout to one group, the tetrahedrite handout to another group, and so forth until each of the seven groups has its own mineral handout. Explain to students that they will be working in two different groups: a learning group and a teaching group. In the learning group, they will read and talk about a mineral. This will prepare them to become an "expert" in the teaching group about how that mineral is used in cell phones.
5. Learning Group: There are seven learning groups, one for each mineral. Depending on how large the class is, there might be four or five students per learning group. Divide the class into seven learning groups and distribute the appropriate handout to the students in each group. Once they are in a learning group, students should read their group's handout and talk about how to explain it to other students. Once each learning group has finished discussing its mineral, have students within each group count off 1 through 4 or 5 (depending on how many are in the group). Then assign students to a teaching group by asking all the "1s" to form a group, all the "2s," to form a group, all the "3s," to form a group, and so forth.
6. Teaching Group: Every teaching group should have seven students, one "expert" for each mineral. Each "expert" has two minutes to teach the other six members of the group about his or her mineral. First, the bauxite "expert" explains how bauxite is used to make cell phones. Then the wolframite "expert" explains how wolframite is used to make cell phones. Then the tetrahedrite "expert" describes how tetrahedrite is used to make cell phones, and so forth through all seven minerals. By the end of the teaching group, all the students will know about seven minerals and how they contribute to cell phones.
7. Discussion: Reconfigure the class into one unit and ask: What key functions of cell phones would be impossible without the minerals you explored today? Point out that public lands provided $11 billion worth of non-energy minerals in 2017 for cell phones and numerous other products, supporting more than 39,000 jobs.

Assessment

Circulate among groups to determine how well students understand and can teach the content on the handouts.

Mineral Handouts for Teaching Groups

Ore Mineral: Chalcopyrite

Source of: Copper, which is used more than any other metal in cell phones

Mined in: Wisconsin, Minnesota

Used for: Conducting electricity, data, and heat

Importance:

- **Without copper to conduct electricity, the cell phone would not work.**
- **Chalcopyrite commonly is found with pyrite in high-sulfur coal seams.**
- **Copper wire was critical to the industrial, digital, and information revolutions.**

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Ore Mineral: Tetrahedrite

Source of: Silver

Mined in: Idaho, Nevada, Colorado, Utah, Arizona, Montana, Arkansas

Used for: Creating electrical pathways through the phone

Importance:

- **Without silver to create electrical pathways, the cell phone would not work.**
- **Though not all tetrahedrite contains silver, silver can substitute into the crystal structure for the copper.**
- **Even though silver is known for use in jewelry, its primary use today is in electronics.**

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Ore Mineral: Wolframite

Source of: Tungsten

Mined in: Utah

Used for: Acting as a heat sink and enabling the phone to vibrate

Importance: Without tungsten and its high atomic weight, the cell phone would not vibrate.

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Ore Mineral: Spodumene

Source of: Lithium

Mined in: Idaho, North Carolina, California, South Dakota

Used for: Used as cathodes in lithium/cadmium batteries

Importance: Without lithium, the cell battery would not hold a charge for long.

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Ore Rock: Bauxite

Source of: Gallium

Mined in: Georgia, Alabama, Arkansas

Used for: Providing light emitting diode (LED) backlighting for the screen

Importance: Without gallium, the cell phone would not be backlit.

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Ore Mineral: Sphalerite

Source of: Indium and Germanium

Mined in: Colorado, Tennessee, Oklahoma, Missouri, Kansas

Used for: Creating the screen's conductive coating

Importance: Without iridium and germanium, the cell phone's touch screen would not work.

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Ore Mineral: Bastnäesite

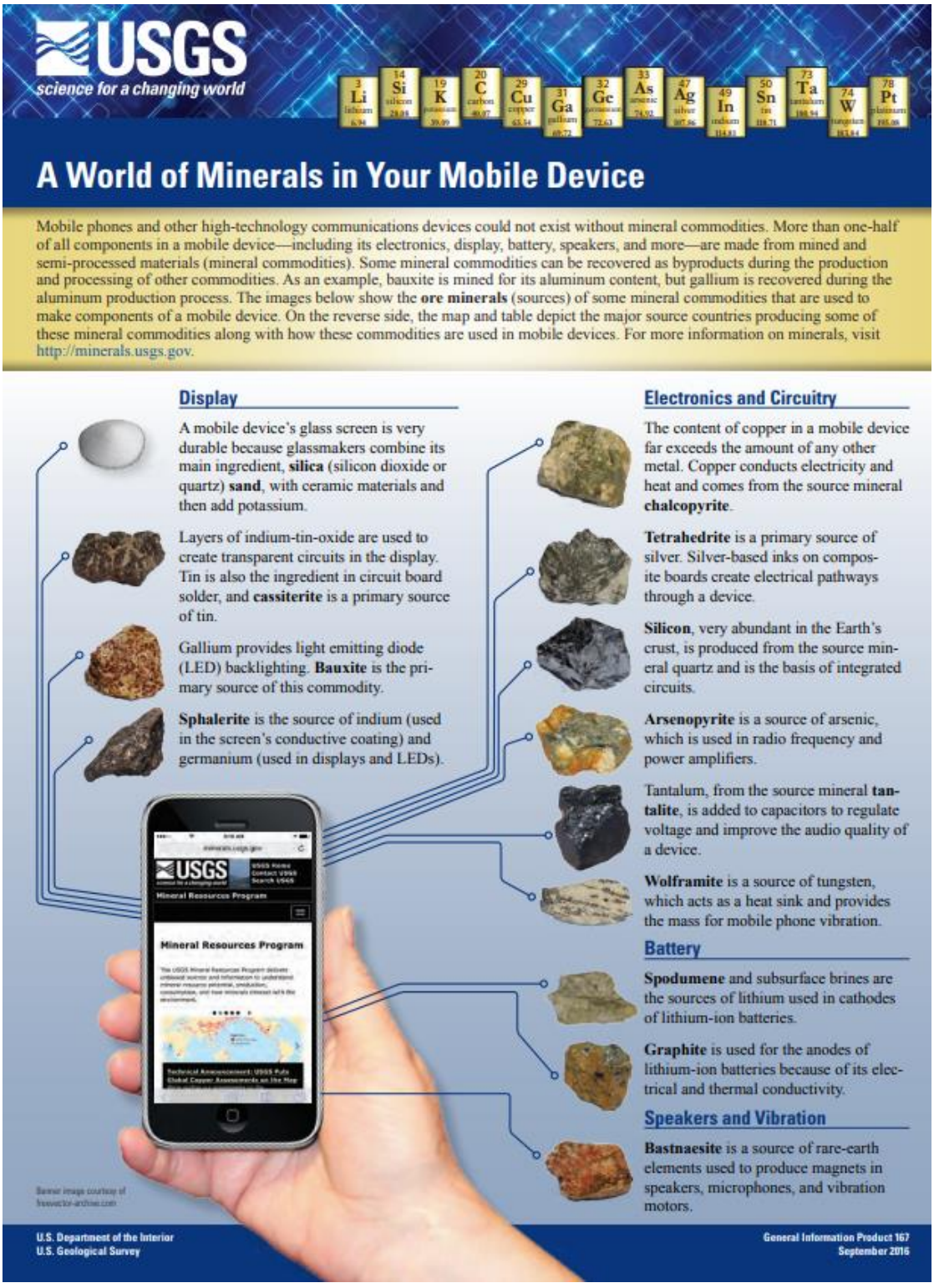
Source of: Rare earth elements

Mined in: California

Used for: Providing magnets for speakers and microphones

Importance: Without rare earths, the cell phone's speakers and microphones would not work.

Note: the elements on the U.S.G.S. chart show up in minute traces in the mineral. When enough of the mineral is mined, the element can be concentrated enough to be of value.



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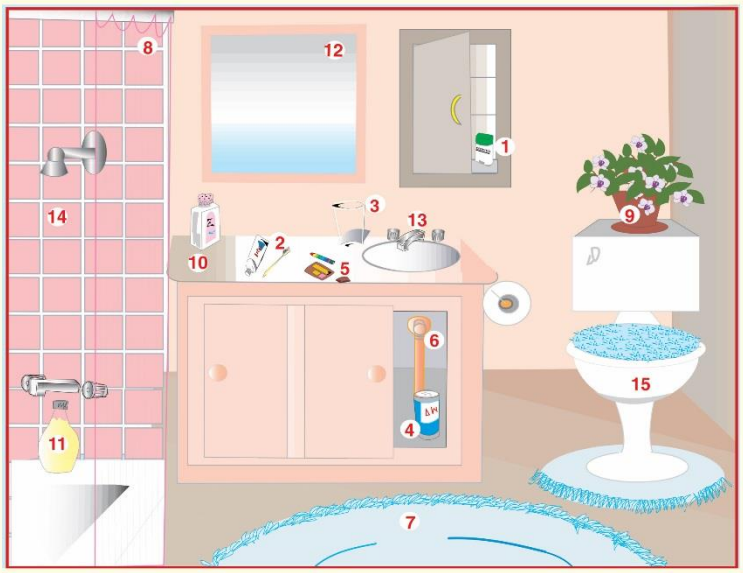
Minerals in Our Environment

Room 1



1. DEODORANT: Includes aluminum and the container is made of petroleum products.
2. TOOTH PASTE: Includes fluorite, barite and calcite. The container is made of petroleum products or aluminum.
3. DRINKING GLASSES: Includes feldspar, silica and soda ash.
4. ABRASIVE CLEANSER: Includes silica or calcite.
5. LIPSTICK AND MAKEUP: Includes clay, mica, talc, limestone and petroleum products.
6. PLUMBING: Made of copper, clay and petroleum products.
7. RUGS: Includes limestone, petroleum products and selenium.
8. PLASTIC SHOWER CURTAINS: Contains petroleum products.
9. FLOWER POT: Made of clays and metallic minerals for pigments in glaze.
10. TALCUM POWDER: Contains talc and mica.
11. DANDRUFF SHAMPOO: Includes coal tar, lithium clays and selenium. The container is made of petroleum products.
12. MIRROR: Includes feldspar, silica and silver.
13. FAUCETS: Includes iron, nickel and chromium.
14. TILES: Made of clay, feldspar, wollastonite or talc, mineral pigments.
15. TOILET: Includes clays, silica, copper, zinc, petroleum products and borates.

[1] Western Region Mineral Resources

Adapted from the USGS publication by
Judy Weathers, John Galloway and Dave Frank[1]
2001

Approved for publication March 2001
Available at http://geopubs.wr.usgs.gov

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Minerals in Our Environment

Room 2

1. COMPUTER: Includes gold, silica, nickel, aluminum, zinc, iron, petroleum products, and about thirty other minerals.
2. PENCIL: Includes graphite and clays.
3. TELEPHONE: Includes copper, gold and petroleum products.
4. BOOKS: Includes limestone and clays.
5. PENS: Includes limestone, mica, petroleum products, clays, silica and talc.
6. FILM: Includes petroleum products and silver.
7. CAMERA: Includes silica, zinc, copper, aluminum and petroleum products.
8. CHAIR: Includes aluminum and petroleum products.
9. TELEVISION: Includes aluminum, copper, iron, nickel, silica, rare earths, and strontium.
10. STEREO: Includes gold, iron, nickel, beryllium and petroleum products.
11. COMPACT DISC: Includes aluminum and petroleum products.
12. METAL CHEST: Includes iron and nickel. The brass trim is made of copper and zinc.
13. CARPET: Includes limestone, petroleum products and selenium.
14. DRYWALL: Includes gypsum, clay, vermiculite, calcium carbonate and micas.

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Room 3

1. RADIO: Includes aluminum, copper, gold, iron and petroleum products.
2. TOASTER: Includes copper, iron, nickel, mica, chromium and petroleum products.
3. ELECTRICAL WIRING: Includes copper, aluminum and petroleum products.
4. MICROWAVE: Includes copper, gold, iron, nickel and silica.
5. STOVE: Includes aluminum, copper, iron, nickel and silica.
6. REFRIGERATOR: Includes aluminum, copper, iron, nickel, petroleum products and zinc.
7. TABLE SALT: Includes halite; light salt can be made from sylvite. Most salt has added iodine.
8. PLATES: Includes clays, silica and feldspar.
9. CUTLERY: Includes iron, nickel, silver and chromium.
10. CLOCK: Includes iron, nickel, petroleum products and silica.
11. STAINLESS STEEL SINK: Includes iron and nickel.
12. BLACKBOARD: Includes clays. Chalk includes limestone or petroleum products.
13. MAGNET: Includes cobalt.
14. DISH RACK: Made of petroleum products.

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Room 4

1. BRICKS: Includes graphite, clays and silica.
2. CONCRETE STEP: Includes gypsum, iron, limestone, clays and silica.
3. BIKE: Includes barite, iron, nickel and petroleum products.
4. DOOR KNOB: Includes copper and zinc, which make brass.
5. SHINGLES: Includes petroleum products and clays.
6. MAIL BOX: Includes copper and zinc, which make brass.
7. WINDOWS: Includes silica, feldspar, soda ash, coal and salt.
8. TOOLS: Includes iron and nickel.
9. SCOOTER: Includes aluminum, calcite, mica, nickel, petroleum products, clays, silica and talc.
10. AUTOMOBILE: Includes aluminum, barite, calcite, iron, lead, mica, nickel, petroleum products, clays, silica and zinc.
11. PAINT: Includes titanium, gypsum, barite and sulfur.
12. LIGHT AND FIXTURE: Includes tungsten, molybdenum, aluminum, silica, copper and zinc.

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